Surface Dynamics investigated with X-ray Photon Correlation Spectroscopy

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X-ray photon correlation spectroscopy used at grazing incidence angles is a powerful tool to study slow surface dynamics of soft matter systems. It is highly surface sensitive, element specific and it overcomes the limitations of dynamic light scattering regarding multiple scattering and accessibility of large length scales only. XPCS has been used successfully to investigate capillary wave dynamics in various aspects, like e.g. on bulk liquids, at the freezing in of surface dynamics close to the glass transition, or dynamics of polymer films in confined geometries. Recently, we demonstrated that slow surface dynamics on nano meter length scales can be investigated with XPCS [1] leading to new insights into non equilibrium surface dynamics.

In this contribution we will report on experimental results of (a) on the surface dynamics of colloidal assemblies and (b) capillary wave dynamics of complex fluids covered by lipid monolayer.

(a) Surface XPCS has been used to measure the slow dynamics of gold particles on polymer films [1]. Above the glass transition of the polymer film the gold particles were found to slowly coalescence. This non equilibrium process is accompanied by a superdiffusive motion of the particles typical for jammed systems in a non-equilibrium system. We investigated also the dynamics of particles at the surface of a colloidal suspension and compare the dynamics to the corresponding bulk behaviour as measured with dynamic light scattering.

(b) We investigated the surface dynamics of DPPC monolayers adsorbed on sol subphases containing nanometer sized mineral particles. Capillary wave spectra have been measured upon compression of the DPPC monolayer revealing a dramatic change of the viscoelastic properties of the layer. This is attributed to the formation of a solid like DPPC layer which is connected to mineral particles present in the sol phase.

[1] S. Streit, C. Gutt, V. Chamard, A. Robert, M. Sprung, M. Tolan, Phys.Rev.Lett. 98, 047801 (2007)